



2006 Minerals Yearbook

RECYCLING—METALS

RECYCLING—METALS

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In 2006, the United States recycled 72 million metric tons (Mt) of selected metals, an amount equivalent to 48% of the apparent supply of those metals (table 1). The United States exported 20.0 Mt of scrap metal and imported 6.6 Mt of these same metals (table 2).

Metals are important, reusable resources. Although the ultimate supply of metal is fixed by nature, human ingenuity determines the quantity of supply available for use by developing economic processes for the recovery from the Earth (the primary source of metal) and from secondary sources (recycled from the use/process stream). The reusable nature of metals contributes to the sustainability of their use.

Recycling, a significant factor in the supply of many of the metals used in our society, provides environmental benefits, such as energy savings and reduced volumes of waste.

Individual annual reviews for each of the metals listed in the tables are in the respective chapters in this volume of the U.S. Geological Survey (USGS) Minerals Yearbook, volume I, Metals and Minerals.

The term “primary” indicates material from ore deposits, and the term “secondary” indicates material from recycling, including used products and residuals from manufacturing. Recycling practices and the description of those practices vary substantially among the metal industries. Generally, scrap is categorized as “new” or “old.” “New” indicates preconsumer

sources, and “old,” postconsumer sources. The many stages of industrial processing that precede formation of an end product are the sources of new scrap. For example, when metal is converted into shapes—bars, plates, rods, or sheets—new scrap is generated in the form of cuttings, trimmings, and off-specification forms. When these shapes are converted to parts, new scrap may be generated in the form of cuttings, stampings, turnings, and off-specification parts. Similarly, when parts are assembled into products, new scrap may be generated.

Once a product completes its useful life, it becomes old scrap. Used appliances, automobiles, and beverage cans are examples of old consumer scrap; used jet engine blades and vanes, junked machinery and ships, and metal recovered from commercial buildings or industrial plants are examples of old industrial scrap. A wide variety of descriptive terms, including external scrap, home scrap, internal scrap, mill scrap, prompt scrap, and purchased scrap, have evolved to describe scrap generated by diverse industry practices. The material flow of recycled metal commodities in the United States has been documented in a series of reports published by the USGS (Sibley, 2004).

Reference Cited

Sibley, S.F., ed., 2004, Flow studies for recycling metal commodities in the United States: U.S. Geological Survey Circular 1196-A–M, 210 p.

TABLE 1
SALIENT U.S. RECYCLING STATISTICS FOR SELECTED METALS¹

Year	Quantity of metal (metric tons)					Value of metal (thousands)			
	Recycled from new scrap ²	Recycled from old scrap ³	Recycled ⁴	Apparent supply ⁵	Percentage recycled	Recycled from new scrap ²	Recycled from old scrap ³	Recycled ⁴	Apparent supply ⁶
Aluminum: ⁷									
2002	1,750,000	1,170,000	2,930,000	8,070,000	36	\$2,510,000	\$1,680,000	\$4,190,000	\$11,500,000
2003	1,750,000	1,070,000	2,820,000	7,880,000	36	2,620,000	1,610,000	4,230,000	11,800,000
2004	1,870,000	1,160,000	3,030,000	8,460,000	36	3,640,000	2,140,000	5,600,000	15,700,000
2005	1,950,000 ^r	1,080,000 ^r	3,030,000 ^r	8,480,000 ^r	36	3,910,000 ^r	2,170,000 ^r	6,080,000 ^r	17,000,000 ^r
2006	2,310,000	1,200,000	3,510,000	8,160,000	43	6,180,000	3,200,000	9,380,000	21,800,000
Chromium: ⁸									
2002	NA	NA	219,000 ^r	647,000 ^r	34 ^r	NA	NA	119,000 ^r	317,000 ^r
2003	NA	NA	250,000 ^r	585,000 ^r	43 ^r	NA	NA	193,000 ^r	484,000 ^r
2004	NA	NA	233,000 ^r	647,000 ^r	36 ^r	NA	NA	287,000 ^r	762,000 ^r
2005	NA	NA	255,000 ^r	629,000 ^r	41 ^r	NA	NA	333,000 ^r	888,000 ^r
2006	NA	NA	235,000	645,000	36	NA	NA	128,000	811,000
Copper: ⁹									
2002	842,000	208,000	1,050,000	3,450,000	30.4	1,410,000	348,000	1,760,000	5,770,000
2003	738,000	206,000	944,000	3,170,000	29.8	1,390,000	387,000	1,770,000	5,950,000
2004	774,000	191,000	965,000	3,330,000	28.9	2,290,000	565,000	2,850,000	9,830,000
2005	769,000	183,000 ^r	953,000 ^r	3,170,000	30.0	2,940,000	698,000	3,640,000	12,100,000
2006	819,000	150,000	968,000	3,000,000	32.3	5,680,000	1,040,000	6,720,000	20,800,000
Iron and steel: ¹⁰									
2002	NA	NA	69,300,000	119,000,000	58	NA	NA	6,450,000	10,200,000
2003	NA	NA	65,500,000	117,000,000	56	NA	NA	7,920,000	13,200,000
2004	NA	NA	66,900,000	132,000,000	51	NA	NA	14,100,000	24,900,000
2005	NA	NA	65,500,000 ^r	121,000,000 ^r	54	NA	NA	12,600,000	21,900,000
2006	NA	NA	65,600,000	136,000,000	48	NA	NA	18,500,000	36,100,000
Lead: ¹¹									
2002	42,600	1,070,000	1,120,000	1,540,000	81.2	40,900	1,030,000	1,070,000	1,480,000
2003	19,300	1,120,000	1,140,000	1,520,000	77.4	18,600	1,080,000	1,100,000	1,470,000
2004	12,900	1,110,000	1,130,000	1,460,000	77.3	15,600	1,350,000	1,370,000	1,440,000
2005	14,200 ^r	1,130,000	1,140,000	1,510,000 ^r	75.9 ^r	19,100 ^r	1,520,000 ^r	1,540,000	2,030,000 ^r
2006	13,500	1,140,000	1,150,000	1,570,000	73.1	23,000	1,940,000	1,960,000	2,680,000
Magnesium: ¹²									
2002	47,100	26,400	73,600	148,000	50	126,000	70,500	196,000	395,000
2003	44,700	25,400	70,100	152,000	46	107,000	60,900	168,000	366,000
2004	51,500	20,500	72,000	179,000	40	167,000	66,400	233,000	582,000
2005	53,500	19,400	72,900 ^r	168,000	43 ^r	172,000	62,400 ^r	235,000 ^r	541,000 ^r
2006	56,000	19,800	75,800	159,000	48	143,000	50,600	194,000	406,000
Nickel: ¹³									
2002	NA	NA	99,300 ^r	220,000 ^r	45 ^r	NA	NA	672,000 ^r	1,490,000 ^r
2003	NA	NA	101,000 ^r	218,000 ^r	46 ^r	NA	NA	971,000 ^r	2,100,000 ^r
2004	NA	NA	103,000 ^r	232,000 ^r	45 ^r	NA	NA	1,430,000 ^r	3,200,000 ^r
2005	NA	NA	101,000 ^r	236,000 ^r	43 ^r	NA	NA	1,500,000 ^r	3,480,000 ^r
2006	NA	NA	108,000	252,000	43	NA	NA	2,620,000	6,100,000
Tin: ¹⁴									
2002	3,790	6,760	10,600	49,100	22	18,400	40,600	59,000	307,000
2003	3,570	5,500	9,070	41,500	22	26,800	41,200	68,000	311,000
2004	3,590	5,240	8,830	53,800	16	43,300	63,200	107,000	649,000
2005	2,280	11,700 ^r	14,000	46,300 ^r	30	24,300	125,000	150,000	495,000
2006	2,340	11,600	13,900	55,500	25	21,700	107,000	129,000	514,000
Titanium: ¹⁵									
2002	NA	NA	11,600	W	40	NA	NA	25,100 ^{r,c}	NA
2003	NA	NA	14,300	W	46	NA	NA	37,500 ^{r,c}	NA
2004	NA	NA	18,300	W	46	NA	NA	110,000 ^{r,c}	NA
2005	NA	NA	25,700	W	50	NA	NA	302,000 ^{r,c}	NA
2006	NA	NA	25,000	W	47	NA	NA	253,000	NA

See footnotes at end of table.

TABLE 1—Continued
SALIENT U.S. RECYCLING STATISTICS FOR SELECTED METALS¹

Year	Quantity of metal (metric tons)				Percentage recycled	Value of metal (thousands)			
	Recycled from new scrap ²	Recycled from old scrap ³	Recycled ⁴	Apparent supply ⁵		Recycled from new scrap ²	Recycled from old scrap ³	Recycled ⁴	Apparent supply ⁶
Zinc: ¹⁶									
2002	319,000	47,300	366,000	1,420,000	25.8	\$272,000	\$40,300	\$312,000	\$1,210,000
2003	295,000	50,300	345,000	1,390,000 ^r	24.8 ^r	264,000	45,100	309,000	1,250,000 ^r
2004	302,000	47,100	349,000	1,430,000 ^r	24.4 ^r	349,000 ^r	54,500	404,000	1,650,000 ^r
2005 ^r	303,000	50,700	354,000	1,290,000	27.4	448,000	75,000	524,000	1,910,000
2006	294,000	47,800	341,000	1,390,000	24.5	1,030,000	167,000	1,190,000	4,870,000

⁶Estimated. ^rRevised. NA Not available. W Withheld to avoid disclosing company proprietary data.

¹Data are rounded to no more than three significant digits; may not add to totals shown.

²Scrap that results from the manufacturing process, including metal and alloy production. New scrap of aluminum, copper, lead, tin, and zinc excludes home scrap, which is scrap generated and recycled in the metal producing plant.

³Scrap that results from consumer products.

⁴Metal recovered from new plus old scrap.

⁵Apparent supply is production plus net imports plus stock changes. Production is primary production plus recycled metal. Net imports are imports minus exports. Apparent supply is calculated on a contained-weight basis.

⁶Same as apparent supply defined in footnote 5 above but calculated based on a monetary value.

⁷Quantity of metal is the calculated metallic recovery from purchased new and old aluminum-base scrap, estimated for full industry coverage. Monetary value is estimated based on average U.S. market price for primary aluminum metal ingot.

⁸Chromium scrap was estimated as chromium content of stainless steel scrap receipts (reported by the iron and steel and pig iron industries) plus stainless steel scrap exports minus imports plus chromium metal waste and scrap exports. For the calculation of apparent supply, trade includes reported or estimated chromium content of chromite ore, ferrochromium, chromium metal and scrap, a variety of chromium-containing chemicals, and stainless steel mill products. Stocks include estimated chromium content of reported and estimated producer, consumer, and Government stocks. Recycled monetary value calculated from quantity using the average annual import value of high-carbon ferrochromium. Apparent supply monetary value calculated from quantity using average annual trade value. Revisions to 2002-05 trade and apparent consumption principally based on the reevaluation of import and export data by adding stainless steel mill products, which account for an increasing amount of chromium introduced to the U.S. economy, and on accounting for the role of stainless steel scrap trade in secondary production.

⁹Includes copper recovered from unalloyed and alloyed copper-base scrap, as refined copper or in alloy forms, as well as copper recovered from aluminum-, nickel-, and zinc-base scrap. Monetary value based on annual average refined copper prices.

¹⁰Recycled scrap reported from consuming manufacturers. Apparent supply measured as shipments of iron and steel products plus castings corrected for imported semifinished products. Recycled unit value is the U.S. annual average composite price for No. 1 heavy-melting steel calculated from prices published in American Metal Market. Unit value for the year used to calculate values of recycled scrap and apparent supply of scrap.

¹¹Lead processors are segregated by primary and secondary producers. This segregation permits inclusion of stock changes for secondary producers. Monetary value of scrap and apparent supply estimated based upon average quoted price of common lead.

¹²Includes magnesium content of aluminum-base scrap. Monetary value based on the annual average Platts Metals Week's U.S. spot Western magnesium price.

¹³Nickel statistics were derived from the following:

Production, consumption, stocks, receipts

- Reported nickel content of products made from reclaimed stainless steel dust, spent nickel-cadmium batteries, plating solutions, and other products.
- Estimated nickel content of reported net receipts of alloy and stainless steel scrap.
- Reported nickel content of recovered copper-base scrap.
- Reported nickel content of obsolete and prompt purchased nickel-base scrap.
- Estimated nickel content of various types of reported obsolete and prompt aluminum scrap.

Trade data

- Reported nickel content of International Nickel Study Group (INSG) class I primary products, including briquets, cathode, flake, pellets, and powder.
- Reported or estimated nickel content of INSG class II primary products, including ferronickel, metallurgical-grade nickel oxide, and a variety of nickel-containing chemicals.
- Estimated nickel content of secondary products, including nickel waste and scrap and stainless steel scrap.

Stock data

- Reported or estimated nickel content of all scrap stocks, except copper.
- Reported nickel content of primary products held by world producers in U.S. warehouses.
- Reported nickel content of primary products held by U.S. consumers.
- Reported nickel content of U.S. Government stocks.

Monetary value based on annual average cash price for cathode, as reported by the London Metal Exchange.

¹⁴Monetary value based on Platts Metals Week composite price for tin.

¹⁵Percentage recycled based on titanium scrap consumed divided by primary sponge and scrap consumption.

¹⁶Monetary value based on annual average Platts Metals Week metal price for North American special high-grade zinc.

TABLE 2
SALIENT U.S. RECYCLING TRADE STATISTICS FOR SELECTED METALS¹

Year	Exports			Imports for consumption		
	Quantity		Value (thousands)	Quantity		Value (thousands)
	Gross weight (metric tons)	Contained weight (metric tons)		Gross weight (metric tons)	Contained weight (metric tons)	
Aluminum:						
2002	613,000	NA	\$603,000	466,000	NA	\$502,000
2003	577,000	NA	633,000	440,000	NA	496,000
2004	660,000	NA	773,000	535,000	NA	655,000
2005	1,090,000	NA	1,370,000	482,000	NA	658,000
2006	1,480,000	NA	2,550,000	527,000	NA	930,000
Chromium:²						
2002	343,000	58,300 ^r	252,000 ^r	81,100 ^r	13,800 ^r	50,600 ^r
2003	505,000	85,900 ^r	386,000 ^r	89,400 ^r	15,400 ^r	71,700 ^r
2004 ^r	478,000	81,400	551,000	146,000	25,000	161,000
2005 ^r	585,000	99,600	675,000	111,000	19,000	124,000
2006	506,000	86,300	720,000	180,000	30,600	210,000
Copper:³						
2002	511,000	407,000	509,000	100,000	80,300	124,000
2003	689,000	558,000	664,000	90,600	70,700	121,000
2004	714,000	578,000	882,000	102,000	79,800	183,000
2005	658,000	556,000	1,060,000	114,000	90,300	270,000
2006	803,000	662,000	1,190,000	118,000	91,600	481,000
Iron and steel:						
2002	9,000,000	9,000,000	1,300,000	3,320,000	3,320,000	403,000
2003	10,900,000	10,900,000	1,960,000	3,690,000	3,690,000	556,000
2004	11,800,000	11,800,000	2,930,000	4,790,000	4,790,000	1,280,000
2005	13,000,000	13,000,000	3,460,000	4,000,000	4,000,000	972,000
2006	14,100,000	14,100,000	4,270,000	5,000,000	5,000,000	1,310,000
Lead:						
2002	106,000	106,000	23,300	2,880	2,570	1,740
2003	92,800	92,800	23,300	4,970	4,600	2,460
2004	56,300	56,300	14,800	5,320	4,770	3,510
2005	67,300	67,300	21,600	3,840	3,340	2,880
2006	121,000	121,000	37,200	1,800	1,560	1,650
Magnesium:						
2002	5,850	5,850	14,700	14,100	14,100	20,900
2003	5,040	5,040	11,800	16,200	16,200	22,000
2004	4,790	4,790	11,300	11,700	11,700	17,600
2005	5,630	5,630	13,100	14,700	14,700	22,700
2006	3,680	3,680	8,410	17,200	17,200	23,700
Nickel:⁴						
2002	1,070,000	42,200	506,000	358,000	10,200	107,000
2003	1,410,000	50,900	704,000	230,000	12,000	138,000
2004	2,240,000	55,200	995,000	453,000	20,000	328,000
2005	2,170,000	61,900	1,190,000	550,000	17,200	304,000
2006	2,890,000	68,600	1,730,000	717,000	22,400	416,000
Tin:						
2002	5,940	5,940	9,740	561	561	736
2003	5,040	5,040	8,630	921	921	686
2004	9,310	9,310	13,200	1,950	1,950	1,700
2005	10,600	10,600	12,100	3,530	3,530	2,010
2006	7,500	7,500	14,100	2,490	2,490	4,470

See footnotes at end of table.

TABLE 2—Continued
 SALIENT U.S. RECYCLING TRADE STATISTICS FOR SELECTED METALS¹

Year	Exports			Imports for consumption		
	Quantity		Value (thousands)	Quantity		Value (thousands)
	Gross weight (metric tons)	Contained weight (metric tons)		Gross weight (metric tons)	Contained weight (metric tons)	
Titanium:						
2002	6,000	NA	\$14,200	6,270	NA	\$17,800
2003	5,320	NA	29,200	5,550	NA	19,700
2004	9,760	NA	56,000	8,830	NA	53,600
2005	20,600	NA	91,400	12,400	NA	162,000
2006	10,800	NA	110,000	12,800	NA	200,000
Zinc:						
2002	19,800	NA	11,200	31,200	NA	9,530
2003	32,300	NA	23,300	10,300	NA	5,740
2004	40,300	NA	39,400	10,800	NA	7,740
2005	46,800	NA	55,000	9,580	NA	8,820
2006	83,800	NA	95,800	14,200	NA	18,700

¹Revised. NA Not available.

¹Contained weight based upon 100% of gross, unless otherwise specified.

²Includes stainless steel scrap and chromium metal waste and scrap. Contained weight for import and export quantities of Harmonized Tariff Schedule of the United States (HTS) code 7204.21.000 is 17% of gross weight.

³For HTS codes 7404.00.0045, 7404.00.0062, and 7404.00.0080 contained weight for import quantity is 65% of gross weight. For HTS codes 7404.00.3045, 7404.00.3055, 7404.00.3065, 7404.00.3090, 7404.00.6045, 7404.00.6055, 7404.00.65, and 7404.00.6090 contained weight for import quantity is 72%.

⁴Contained weight for import and export quantities is 0.4% of gross weight for HTS code 7204.29.000, 50% for HTS code 7503.00.00, and 7.5% for HTS code 7204.21.0000.